season of tornadoes in the Mississippi Valley extends from April to September, inclusive.

Q. In case a cyclone cellar is not available, what, in your estimation, would be a safe place?

Ans. The southwest portion of the cellar of a frame house.

Q. What about cellars in brick buildings during such storms; are they safe?

Ans. That depends entirely on the severity of the tornado. Some tornadoes merely destroy the roof of brick houses; some cause the walls to crumble or fall outward. The cellar of a brick house is probably safer than any other place in that particular structure. In the Omaha tornado of March, 1913, very few brick houses were seriously damaged.

Q. What time of day do these storms occur?

Ans. Generally from 3:30 to 5 p. m.

Q. Have there been any at night?

Ans. Yes.

Q. Have the municipalities any way of notifying the people, and how?

Ans. The place where a tornado will form can not be foretold. Tornadoes, like thunderstorms and hailstorms, occur, for the most part, on warm, sultry afternoons, in the late spring and in summer. While the precise path of these storms can not be accurately foretold, the weather maps show when the conditions are favorable to their generation.

The local signs of the approach of a tornado are ominous clouds, first in the southwest and then almost immediately in the northwest and north. The appearance of a pendant funnel-shaped cloud may be taken as conclusive evidence of the presence of a tornado. If a funnel cloud can not be observed, its existence can be known by a peculiar roaring noise, somewhat like the rumbling of distant thunder or the approach of a train of heavy cars.

If one can see the tornado cloud and gain an idea of its direction of motion, then the zone of safety is in a line at right angles to the direction of motion. If the tornado is moving toward the northeast, then one should run toward the northwest, provided, of course, the storm is about to move a little to the south of the observer's position.

The southern margin of a tornado is more dangerous than the northern, and one should take advantage of this fact in the endeavor to reach a place of safety, remembering that usually the width of the path of great destruction does not cover more than a couple of city blocks and that comparative safety may be found only a short distance at right angles to the line of advance of the tornado.

DETERMINATION OF OZONE AND NITROGEN OXIDES IN SOUTHERN INDIA.[2]

By F. L. USHER and B. S. RAO.

[*Reprinted from* Science Abstracts, Sect. A, Oct. 31, 1917, §1094.]

The more rapid decay of rubber articles and textile fabrics in the Tropics generally is ascribed to the intense light and heat, and the supposed higher percentage of ozone, hydrogen peroxide, and nitrogen oxides in the tropical atmosphere. As there are hardly any reliable data concerning these percentages, the authors undertook this determination at Bangalore College in southern India (Mysore). Rothmund and Burgstaller have shown that the potassium iodide method of estimating ozone and hydrogen peroxide is untrustworthy, they rely on the oxidation by ozone of alkaline or neutral sodium nitrite to nitrate, and they let the air to be analyzed replace water, instead of bubbling it through water. The air is sucked through tubes charged with chromic acid (which destroys H_2O_2) and MnO_2 (neither of these two reagents attack nitrogen peroxide).

Only 14 complete determinations have been made so far, and in 12 of these none of the three gases were found; twice nitrogen peroxide was observed, 1 part in 4,000,000 or 5,000,000 of air. Conclusions are not yet drawn, but it is pointed out that apparently ozone and nitrogen peroxide never occur together in the atmosphere, probably because they would react with one another under formation of nitric acid.—*H. B[orns]*.

[2] Trans., Chem. soc. J., Aug., 1917, 111: 799–809.

PITFALLS OF METEOROLOGICAL PERIODICITIES.

By W. W. B[RYANT].

[*Reprinted from* Nature, London, Nov. 29, 1917, 100: 246–7.]

There is a real danger that some meteorologists, resenting the accusation frequently made against them of accumulating masses of data without making any real use of them, may be tempted to apply the processes of mathematical analysis to any and every set of observations, regardless of the considerations which limit the suitability of the method for the particular data proposed for analysis. This may easily be the case when hunting for periodicity. There is a great temptation, especially for anyone accustomed to the regularity of so many cosmic phenomena, such as eclipses, comets, planets, etc., to expect to find such periods recurring in the weather, but the work before us, consisting of the essential portions of a dissertation by Dr. Ryd—fortunately thought worthy by Capt. Ryder, director of the Danish Meteorological Institute, of a wider publication and so included in the Communications of the Institute and done into intelligible English—should be studied before much time is spent in the search.[1]

Dr. Ryd sets out clearly certain characteristics of meteorological data, wherein they differ essentially from e. g., astronomical data. One of these is the impossibility of eliminating some forms of "systematic" error, which are too likely to be variable to be strictly systematic, such as the difference between the indications of a thermometer, under various conditions of exposure, and the real temperature of the air. Another is an error neither accidental nor systematic, but due to the fact that the data are meteorological; a good example of this is afforded by the mean diurnal variation of air temperature as shown on (*a*) overcast or (*b*) cloudless days.

Dr. Ryd regards harmonic analysis applied to such data as an excellent interpreter, but a very untrustworthy probe. The known periods—the day and the year—are unexceptionable, and the variation from hour to hour in one case, and from day to day, or preferably from "pentad" to "pentad," in the other, are obviously fit subjects for analysis. Dr. Ryd prefers to use both sine and cosine terms instead of the usual transformation, because the determination of mean error is more direct when two constants enter similarly. This is clearly important, as the mean error is a vital consideration. Analysis for testing a real period, such as one of the lunar periods, on the meteorological data is not quite so risky as tentative fishing for an unknown period, in

[1] Publikationer fra Det Danske Meteorologiske Institut Meddelelser. No. 3, "On Computation of Meteorological Observations, by *V. H. Ryd* (Copenhagen, 1917).

which case at least one coefficient, according to Dr. Ryd, must be five times its probable error before it can be regarded as likely to be real.

The brochure is divided into two sections, the first dealing generally with such routine problems as the computation of the mean error, smoothing and adjustment of observational data, and harmonic analysis, with an additional chapter on secondary minima and maxima in the annual variation of the temperature, in which the author deals with the proverbial "Ice-men" of May 11, 12, and 13, and exposes the weakness of Dove's supposed proof of the reality of this legendary phenomenon. The second part deals fully with "mechanical" adjustment, factors of variation, and suggestions on the choice of adjusting formulæ, of which several are given, and a longer chapter is devoted to the working out of four concrete examples, viz, the hourly inequality of air temperature, Greenwich, 1849 to 1868; and of pressure, Greenwich, 1854 to 1873; the annual inequality of pressure, Batavia, 1876 to 1905; and the annual variation of temperature, Copenhagen, 1875 to 1910, the last being a case of partial data—only three observations at fixed hours of the day, instead of the full set.

Dr. Ryd reminds the reader that when data such as July air temperature for 20 years are entered in rows for days and in columns for years, they can not be analyzed similarly in both directions, inasmuch as the successive days are not independent, while the columns are. He also discusses at some length the "order" to which harmonic analysis, if used for adjustment, should be pushed, with hints for saving labor; but on the whole he prefers the "mechanical" adjustment with a suitable formula in the majority of cases, and thinks this method less liable to introduce new errors into a problem.

RELATION BETWEEN BAROMETRIC PRESSURE AND THE WATER LEVEL IN A WELL AT KEW OBSERVATORY.

By E. G. BILHAM.

[Presented to the Royal Society, London, Nov. 15, 1917.]

(*Reprinted from* Nature, London, Nov. 22, 1917, 100: 239.)

The water level shows a well-marked response to changes of barometric pressure at all times of the year. Under similar conditions a given increase of pressure, δp, will depress the water level in the well by an amount δu, which is proportional to δp. The value of $\delta u/\delta p$ varies with the mean level of the water, but is always negative. The validity of the equation $\delta u = a.\delta p$ was established between limits given by $dp/dt > 0.5$ mb./hr., and the value of a was determined in the case of three groups of months representing high, intermediate, and low levels. The sensitiveness of the water level to pressure was found to increase rapidly with the height of the water, the value of a for a height of 360 cm. above mean sealevel being four times as great as for a height of 200 cm. The change of sensitiveness appears to be entirely due to the change in the condition of the soil. The average value of a is 1.1 mm./mb. There appears to be no lag in the response of the well to changes of pressure, and under favorable conditions the most rapid fluctuations of pressure are shown on the water level trace.

In the original of this paper Mr. Bilham has worked out in mathematical detail careful observations similar to the more general ones discussed by the undersigned in the REVIEW for February, 1916, p. 75–76.—C. A., jr.

PHENOMENA CONNECTED WITH TURBULENCE IN THE LOWER ATMOSPHERE.

By G. I. TAYLOR.

[Presented to the Royal Society, London, Nov. 15, 1917.]

(*Reprinted from* Nature, London, Nov. 22, 1917, 100: 239.)

In a previous paper by the author it was shown theoretically that a connection should exist between the rate at which heat is conveyed into the atmosphere by means of eddies, and the amount of retardation of the velocity of the lower layers of the atmosphere behind the gradient velocity due to the friction of the ground. In the present paper the amount of the turbulence over Paris is calculated from temperature observations taken on the Eiffel Tower. It is shown that the amount is the same as that calculated from observations of the change in direction of the wind between the bottom and top of the Eiffel Tower due to the friction of the ground. The daily variation in wind velocity which depends on the daily variation in turbulence is next discussed, and it is shown that the chief characteristics of the observed phenomena of daily variation are explained, both qualitatively and, so far as is possible, quantitatively by the author's equations.

SWISS SOCIETY OF GEOPHYSICS, METEOROLOGY, AND ASTRONOMY.[1]

Under M. Mercanton of Lausanne, as chairman, a circle of the more active Swiss physicists, meteorologists, and astronomers assembled in the great physics lecture room of the University of Berne on April 28, 1917, to organize the society of the above name (Société Suisse de Géophysique, Météorologie et Astronomie) and adopt statutes in conformity with its proposed activities as a section of the Helvetian Society of Natural Sciences (Société helvétique des Sciences naturelles). The following officers were elected for 1917–1919: President, Prof. Dr. P.-L. Mercanton, of Lausanne; vice-president, Prof. Dr. A. de Quervain, of Zurich; secretary-treasurer, Prof. A. Kreis of Coire.

The first regular general meeting of the society was held September, 11, 1917, at Zurich, with an attendance of 34, out of 70 members already enrolled. The assemblage was welcomed, in the name of the Helvetian Society of Natural Sciences, by Dr. J. Maurer, Director of the Federal Meteorological Bureau, who congratulated the young society on the lively interest already awakened for it, and then retired in favor of the president, M. Mercanton.

After some discussion, the society unanimously adopted the proposal by P. Ditisheim (La Chaux-de-Fonds), a noted Swiss horologist, that the Federal Council be requested to adopt the serial numeration of the hours of the day, 1 to 24. This is a conscious renewal of the majority recommendation of the International Prime Meridian and Time Congress of Washington (1884), but would be only a rather tardy step for the Swiss Government. The system has been in use on the Indian railways since 1859, was legalized for Canada in 1891,[2] was actually introduced into Italy in 1893 with the adoption of Central European Time, was approved in 1895 at the London (fifth) session of the International Railway Congress, was adopted in Belgium in 1897, and put into practice by the Bureau des Longitudes (Paris) in all its publications in 1900; has been used by the French railways since July 1,

[1] Compte rendu des séances de la Société Suisse de Géophysique, Météorologie, et Astronomie (G. M. A.) *in* Archives des sci. phys. et nat., 122ème année, 4 ème pér., Genève, 15 nov. 1917, 44: 345, 8ol.

[2] The system has been in actual use on the C. P. railway west of Winnipeg for many years.